Piscivorous Impacts on Juvenile Chinook

Salmon Bay Estuary, the Ship Canal and Lake Sammamish

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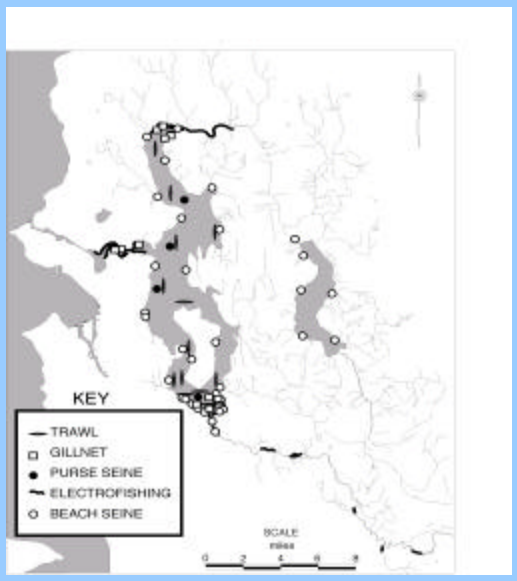
Why Investigate Predation on Chinook?

- Chinook populations in Lake WA have been declining over the last decade
- Low survival of chinook rearing and migrating in the Lake Washington basin has been documented

Lake Washington Basin Piscivore Sampling 1997- 1999



• Lake Washington has been extensively sampled for piscivores

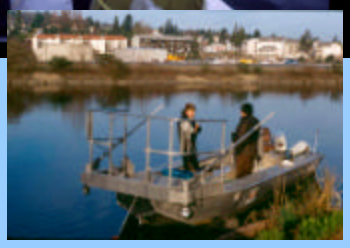
1999, 2000 & 2001 Study Sites

• Chinook predation has been observed primarily in these three areas

Methods

- In The Field
- In The Lab
- Diet Analysis

Fish Catches and Processing



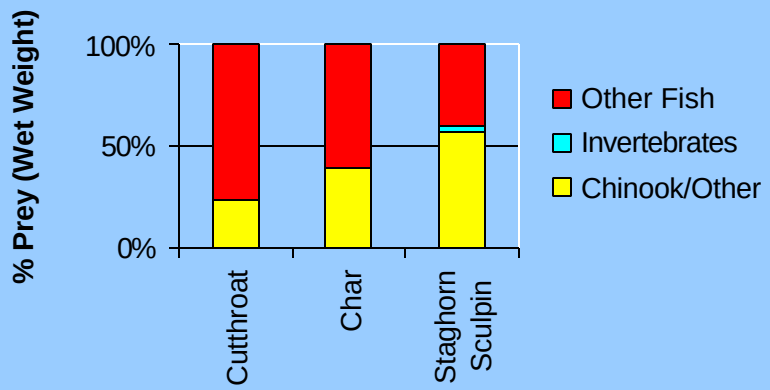
Laboratory Analysis

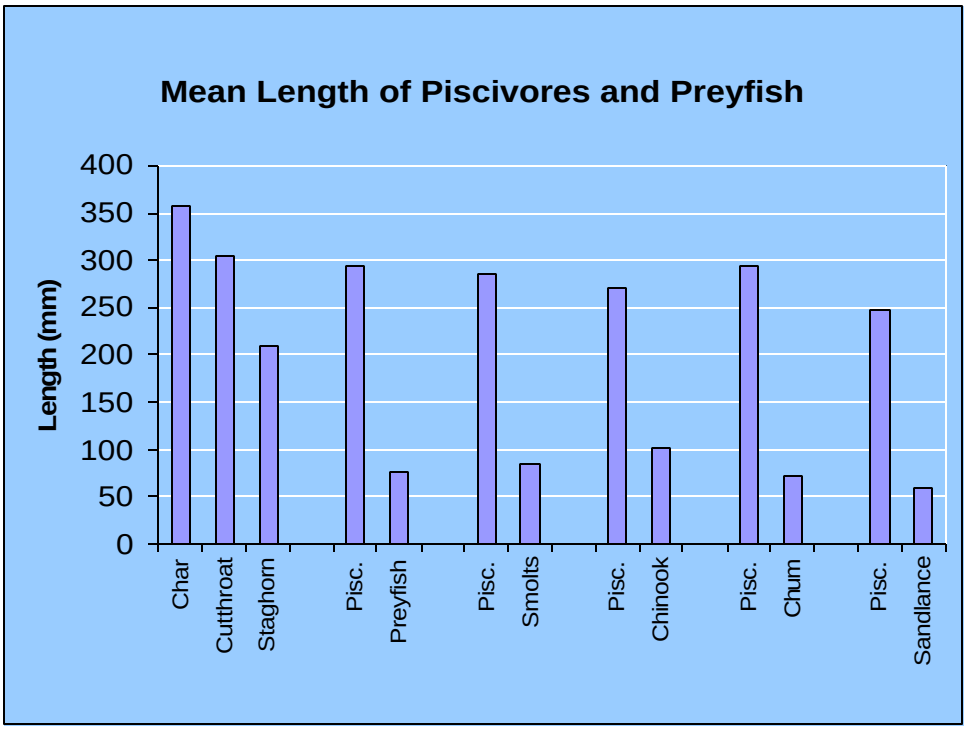
Salmon Bay Estuary

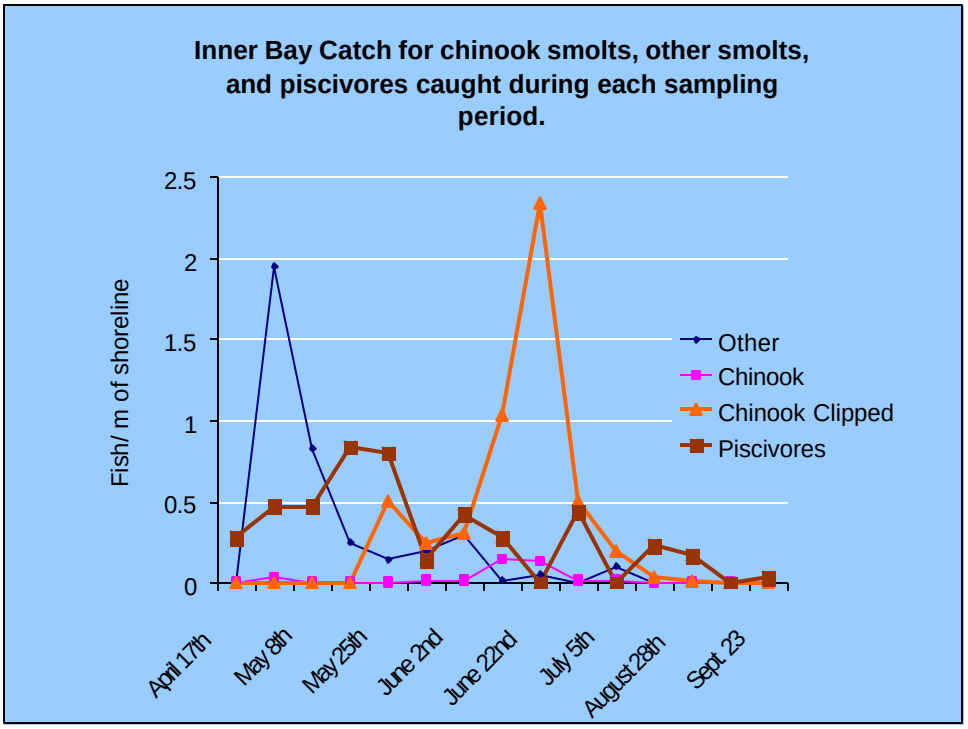
Study Site Locations

Chinook Consumption

Diet Compostition of the Primary Piscivores in the Inner Bay



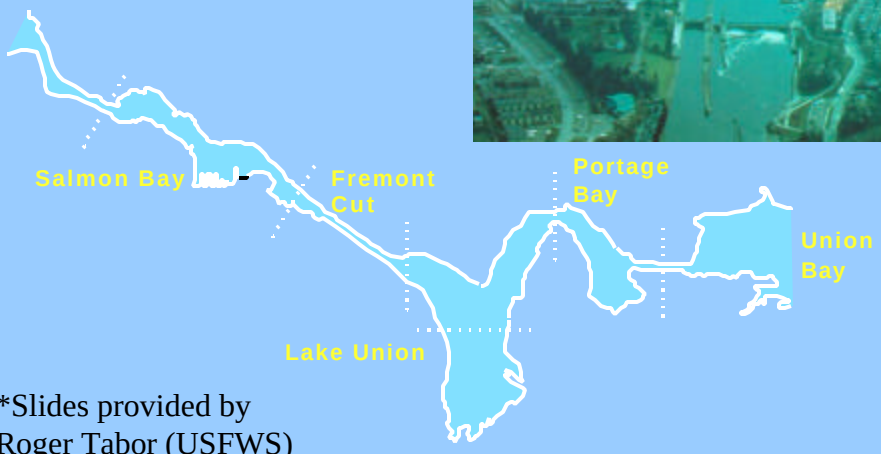

Mean Length of Piscivores and Preyfish
Length (mm)
400
350
300
250
200
150
100
50
0
Char
Cutthroat
Staghorn
Pisc.
Preyfish
Pisc.
Smolts
Pisc.
Chinook
Pisc.
Chum
Pisc.
Sandlance


Inner Bay Catch for chinook smolts, other smolts, and piscivores caught during each sampling period.
Fish/ m of shoreline
2.5
2
1.5
1
0.5
0
April 17th
May 8th
May 25th
June 2nd
June 22nd
July 5th
August 28th
Sept. 23
Other
Chinook
Chinook Clipped
Piscivores

Conclusions

- Piscivore Catches were Low
  - Gear Bias
- Consumption Low
  - Predation Buffer
- Locks Operation a Factor?
  - Freshwater Lens
  - Residence Time
  - The Pelagic Zone ?

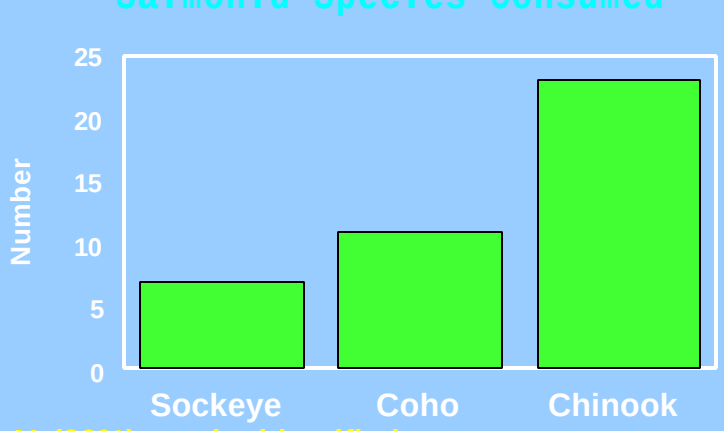
The Ship Canal



*Slides provided by
Roger Tabor (USFWS)

Ship Canal Sample Areas, 1999

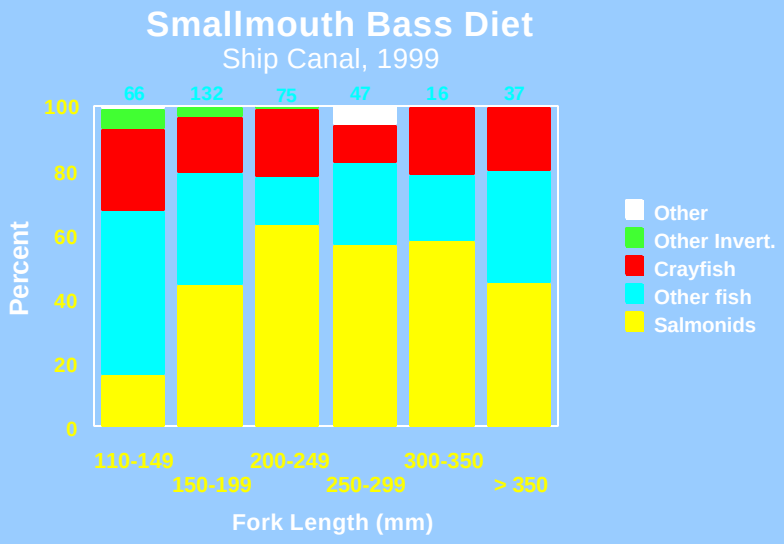
Chinook Consumption



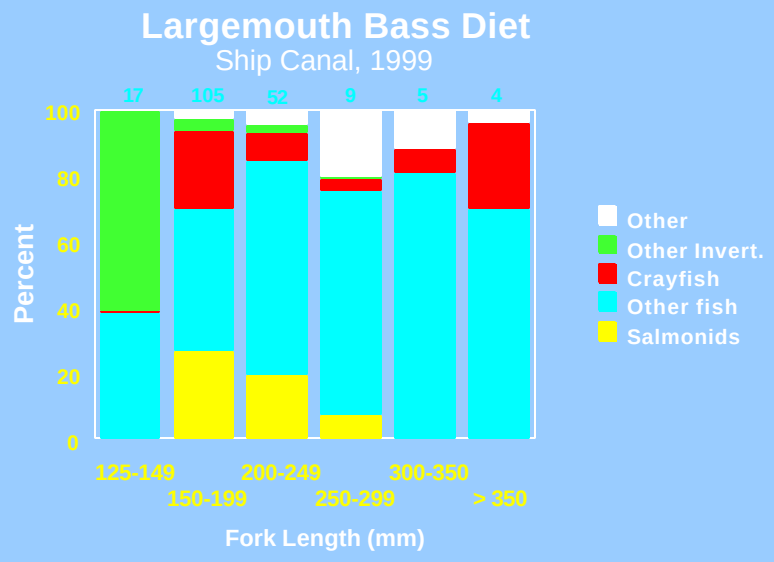
Note: 41 (20%) smolts identified

168 (80%) smolts left unidentified

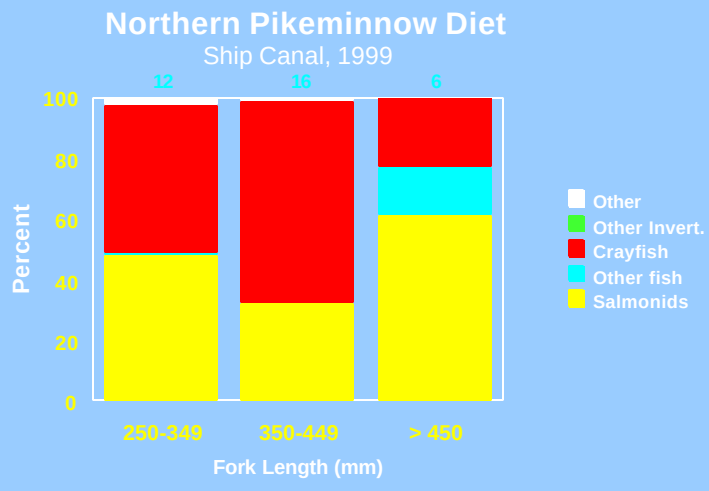
Ship Canal Diet



Ship Canal Diet



Ship Canal Diet

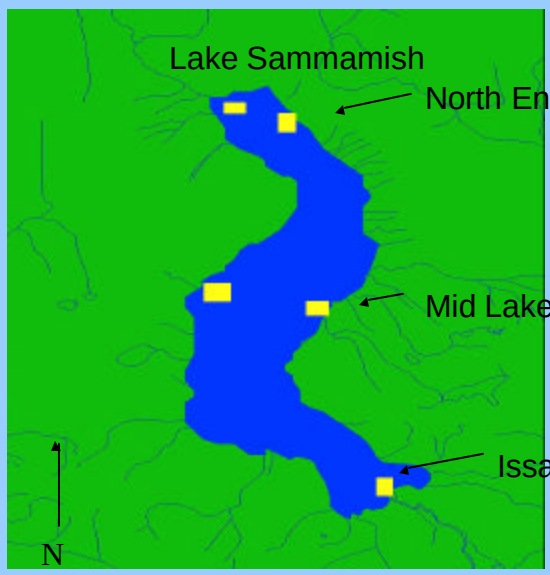


Conclusions

- **Chinook salmon were the main salmonid species consumed**
- **Consumption of smolts occurred primarily from mid-May to the end of July**

Lake Sammamish

Study Site Locations



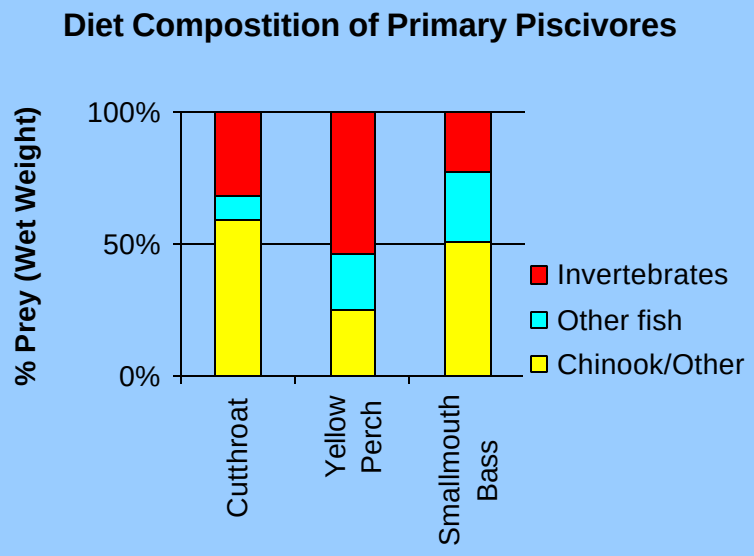
Sampling Dates 2001

Issaquah Mouth	Mid Lake	North Lake	Beach Sein
24-Apr	25-Apr	26-Apr	24-May
1-May	2-May	24-May	
18-May	23-May	1-Jun	
22-May	31-May		
30-May	8-Jun		
5-Jun			

Piscivore Catch Data and Salmonid Presence

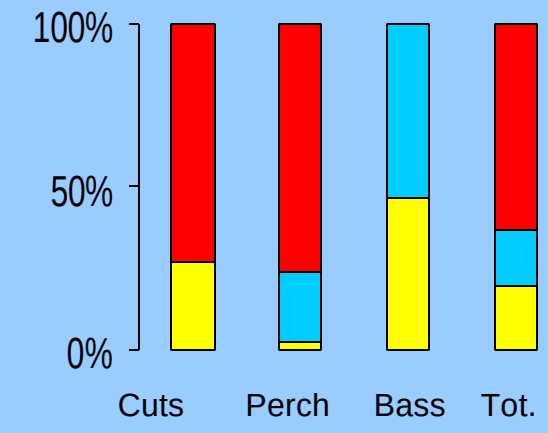
	Catch Data			Stomach Data		
	# of Pisc	CPUE	% E	Chinook	Uni's	FOO
Yellow Perch	312	0.097	33	10	13	0.11
Smallmouth Bass	20	0.006	45	5	8	1.18
Cutthroat Trout	89	0.028	19	15	10	0.35
Rainbow Trout	9	0.003	8	0	3	1.67
Northern Pikeminnov	7	0.002	50	0	1	0.29
Chinook Res.	4	0.001	40	0	0	0
Coho 2 Yr.	6	0.002	100	0	0	0
Sockeye Adult	13	0.004	100	0	0	0
Total	460	0.129	29	30	35	0.22

% Prey (Wet Weight) for Entire Sampling Period



% Prey (Wet Weight) by Sampling Period

April 24, 26

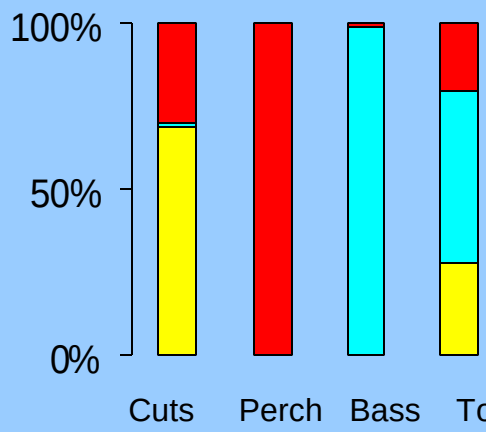


- Invertebrates dominate perch diet in late April
- Chinook present in the diets primarily cutthroat and bass

Invertebrates
Other Fish
Chinook/Uni's

% Prey (Wet Weight) by Sampling Period

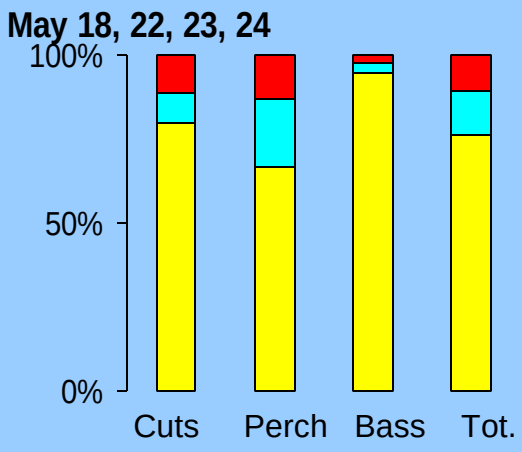
May 1,2



- Cutthroat only piscivore observed consuming chinook in early May

Invertebrates
Other Fish
Chinook/Uni's

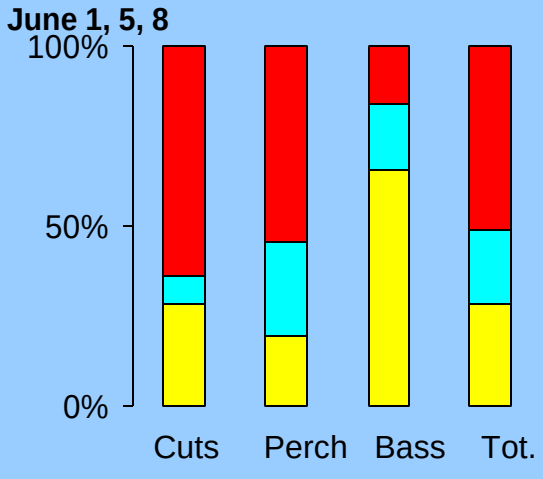
% Prey (Wet Weight) Cont…



- Chinook and other smolts replace invertebrates as primary prey item mid May
- Over fifty percent of perch diet is chinook and other unidentified smolts in late May

Invertebrates
Other Fish
Chinook/Uni's

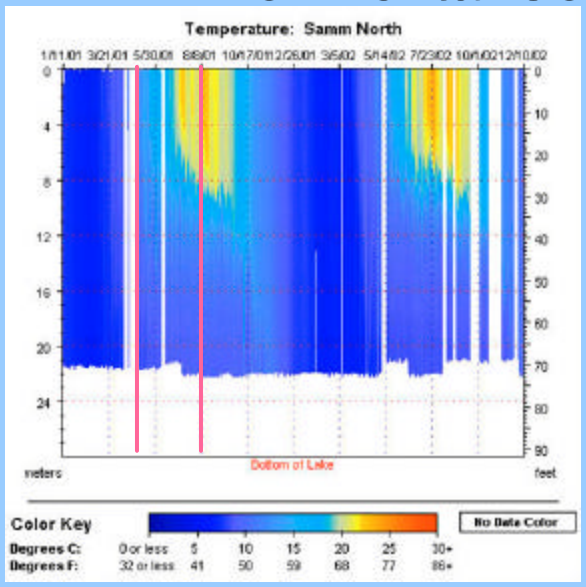
% Prey (Wet Weight) Cont…



- Begin to see a drop off of chinook in perch and cutthroat in early June
- Over fifty percent of smallmouth diet is chinook in early June

Invertebrates
Other Fish
Chinook/Uni's

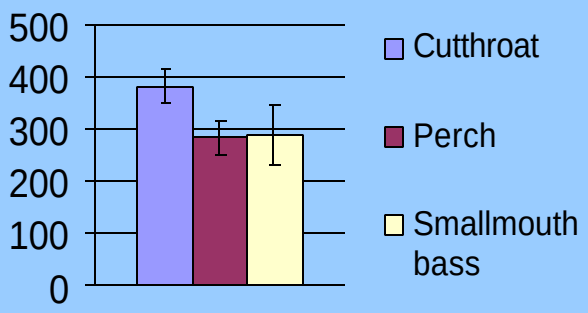
Environmental Conditions



- Temperature ranged from 15 to over 20 *C over the sampling period
- Temperature increases coincide with greater consumption
- Temperature was at about 17 *C during greatest consumption period

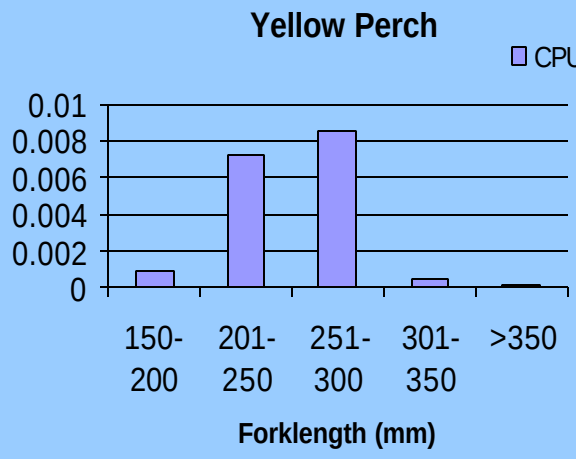
* Temperature data and chart provided by King County

Mean Fork Length of Piscivores Consuming Chinook



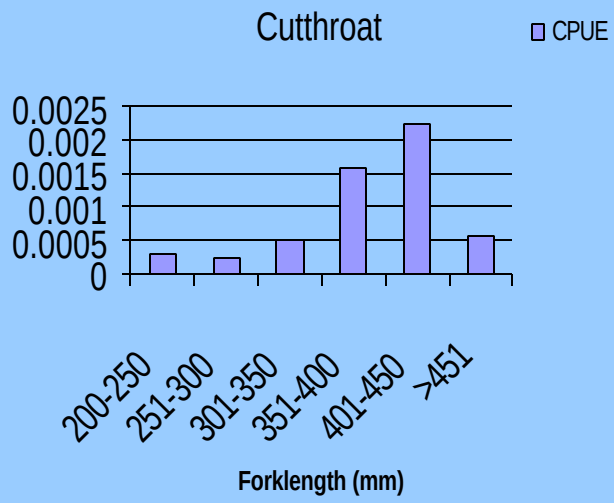
- Mean length of perch consuming chinook was 282mm
- Mean length of cutthroat consuming chinook was 380mm
- Mean length of smallmouth consuming chinook was 288mm

Piscivore per m² by Size Class



- Yellow perch between 200-300 mm were caught the most frequently
- Perch of this size fall within the range found to consume chinook

Piscivore per m² by Size Class



- Mean forklength for cutthroat consuming chinook was 380 mmwhich falls within the second highest catch category
- The range around the mean was as high as 410 so fish from the highest catch category should be considered as well

Conclusions

- Yellow Perch

  Previously not considered important part of Piscivorous Impacts

  Large population

- Cutthroat Trout

  Major consumer in Lake Sammamish as well

- Smallmouth Bass

  Sampling method not effective at capturing these fish

- Consumption of chinook peaked in the third week of May and was still present in first week of June

Additional Work

- Scale samples were taken still need to be analyzed for age structure
- Population Estimates?
- Consumption Estimates– Direct & Bioenergetic
- Bass specific study
- Extend work beyond June 8th to see predation rate decrease significantly
- Continue to get positive ID on unidentified salmonids

Overall Conclusions

- Predation on chinook in the nearshore saltwater area below the locks was low--- pelagic zone??
- Predation on chinook by smallmouth bass in the Ship Canal is significant. Northern Pike Minnow a major player as well??

Overall Conclusions cont.

- Yellow perch predation on chinook in Lake Sammamish is significant because of the large population. Smallmouth Bass seem to be a major player here as well.
- Cutthroat eat salmonids everywhere in the system

Why are these results significant?

- Piscivore impacts need to be considered in relation to chinook survival in the basin
- Evidence is mounting that urbanization impacts have artificially boosted cutthroat populations
- Yellow perch and bass are exotic species